



NOAA Research in Colorado



CO-1 through 6 (Statewide)

Climate and Global Change Program

NOAA is responsible for providing climate information to the nation in order to prepare and protect climate sensitive sectors of society and the economy. To carry out this mission, NOAA's Climate and Global Change Program conducts focused scientific research to understand and predict variations of climate. The program is comprised of a number of research elements, each focusing on a specific aspect of climate variability. Taken together, this research contributes to improved predictions and assessments of the effects of climate variability and change on different environments over a continuum of time scales from season to season, year to year, and over the course of a decade and beyond. This research is accomplished through the strong support of the academic and private sectors, as well as NOAA and other federal laboratories. In FY 2001, NOAA's Climate and Global Change Program provided approximately \$18.6 million in support of climate research in the State of Colorado. For more information please visit <http://www.ogp.noaa.gov>

CO-2 (Boulder)

Aeronomy Laboratory

NOAA's Aeronomy Laboratory (AL) in Boulder conducts research on chemical and physical processes of the Earth's atmosphere to advance the capability to observe, understand, predict, and protect the quality of the atmosphere. Through laboratory, modeling, and field research, AL scientists are advancing the scientific understanding of chemical and physical processes related to the ozone layer, the climate system, and air quality. Several issues addressed by the research are highly relevant to society, including climate studies related to the chemistry of greenhouse gases and the El Niño-Southern Oscillation. The Aeronomy Laboratory is a \$11.9 million laboratory (\$6.4 million of NOAA base) located in Boulder with a staff of 117, including 45 federal and 62 university employees. In addition to climate research, the AL also conducts research relating to air quality in the upper and lower levels of the atmosphere. Specifically, the AL focuses on ozone depletion in the stratosphere and elevated ground-level ozone in the lower atmosphere. Ozone depletion in the stratosphere allows higher concentrations of harmful UV rays from the sun to reach Earth's surface, and high concentrations of ground-level ozone can damage the human respiratory system. For more information please visit <http://www.al.noaa.gov>

CO-2 (Boulder)

Climate Diagnostics Center

NOAA's Climate Diagnostics Center (CDC) in Boulder provides an understanding of the nature and causes of climate variability on time scales from weeks to centuries. CDC uses state-of-the-art

diagnostic and modeling techniques to identify the causes and potential predictability of important climate phenomena. Climate phenomena of interest include droughts, floods, heat waves, cold spells, and the effects of the El Niño-Southern Oscillation. These short-term climate variations can have enormous social and economic impacts. CDC generates experimental seasonal predictions both of the ocean (e.g., El Niño/La Niña) and the resulting atmospheric circulation up to a year in advance. The impact of these changes in atmospheric circulation are being transformed into regional climate information on water supply and demand that are needed by water resource managers throughout the West. CDC also works in collaboration with university social scientists to investigate the process of how climate information and products are being used or could be used by Colorado water resource managers to provide NOAA with a knowledge base for enhanced decision support. CDC has prepared climate briefing documents and provided online demonstrations of climate products to representatives of the Ute Mountain and Southern Ute tribes and to state and local water managers in the Arkansas basin of eastern Colorado. CDC scientists are also working with U.S. Bureau of Reclamation reservoir managers in the state to develop ways to use climate information in reservoir management. In support of these projects, CDC has developed a web site with links to regional climate resources at <http://www.cdc.noaa.gov/ClimateInfo>

CO-2 (Boulder)

Climate Monitoring and Diagnostics Laboratory

NOAA's Climate Monitoring and Diagnostics Laboratory (CMDL) in Boulder conducts research related to atmospheric constituents that are capable of forcing change in the climate of the earth or that may deplete the ozone layer. CMDL operates four Baseline Observatories at Point Barrow, Alaska; Mauna Loa, Hawaii, American Samoa; and the South Pole. Continuous measurements of greenhouse gases, aerosols, ozone, ozone-depleting gases and solar radiation are made at these observatories with some records dating back to 1957. In FY 2000/2001, CMDL upgraded the baseline observatories to promote future research. CMDL operates on a budget of \$9.8 million (\$4.0 million of NOAA base), with a total staff of 88 employees, including 53 federal employees and 35 university employees. The core of the laboratory staff are in Boulder, with 15 field staff distributed at the Baseline Observatories. For more information please visit <http://www.cmdl.noaa.gov>

CO-2 (Boulder)

Environmental Technology Laboratory

The mission of the Environmental Technology Laboratory (ETL) is to improve the nation's geophysical research and services by developing, demonstrating and transferring cost-effective remote measurement systems. ETL gathers experts on all aspects of the interaction of radio, radar, light and sound waves with the ocean and atmosphere. Using these waves, ETL scientists find innovative ways to study atmospheric and oceanic processes and to probe regions that are not readily accessible by direct measurement. ETL's contributions support NOAA's largest and most important single service, namely, weather forecasts and warnings. ETL radars have been used in recent studies in Colorado to demonstrate remote sensing techniques for precipitation measurement. Radar studies are also underway in Colorado to develop new methods of detecting icing conditions hazardous to

aircraft. ETL is an \$18 million dollar laboratory (\$4.5 million in NOAA base), with a staff of 130, including 65 federal employees, 27 contractors and 38 university staff. For more research please visit <http://www.etl.noaa.gov>

CO-2 (Boulder)

Forecast Systems Laboratory

NOAA's Forecast Systems Laboratory (FSL) in Boulder is organized to transfer scientific and technological developments in atmospheric and oceanic research to the Nation's operational forecast services. FSL supports NOAA's efforts to improve its ability to observe, understand and model the environment and weather and to effectively disseminate its products and services to various users. FSL released the interim upgrade of its High Performance Computing System known as Jet to the user community in August, 2001. This upgrade added 280 additional Alpha CPUs to Jet, bringing the total number of computational processors to 560. Jet provides computational capability for FSL modeling efforts, North American Observing Systems (NAOS) tests, high performance computing software development, and other NOAA entities. The latter includes eight other NOAA Research Labs, National Weather Service/NCEP, and several joint institutes. Jet is the 56th most powerful computer in the world. It will save lives and property by improving forecasts of severe weather such as thunderstorms, tornadoes and winter storms. Jet will also further the development of the next generation of mesoscale models, including the Weather Research and Forecast Model, that will be better, faster, and more accurate than any models that are currently available. A final upgrade of Jet is scheduled for July, 2002. For more information please visit <http://www.fsl.noaa.gov>

CO-2 (Boulder)

Space Environment Center

NOAA's Space Environment Center (SEC) in Boulder is the nation's official source of space weather alerts and warnings. These alerts and warnings are issued when space weather disturbances may affect people or equipment working in space or on Earth. Disturbances can adversely impact radio navigation, communication, satellite operations, and electric power distribution. SEC conducts research in solar-terrestrial physics, develops techniques for forecasting solar and geophysical disturbances, and provides real-time monitoring and forecasting of solar and geophysical events. SEC's research scientists study the sun's electromagnetic, particle, and magnetic-field emissions and the processes by which they affect Earth's space environment. SEC also takes a leading role in advocating and designing new data systems that are placed on government satellites. SEC is a \$6 million dollar laboratory (\$5.4 million in NOAA base) with 65 employees, including federal, university, and contract employees. SEC is also one of the National Weather Service's National Centers for Environmental Prediction. For more information please visit <http://www.sec.noaa.gov>

CO-2 (Boulder)

Air Resources Laboratory Surface Radiation Research Branch

The Surface Radiation Research Branch (SRRB) of the Air Resources Laboratory is located in Boulder. SRRB's primary emphasis is to provide quality surface radiation measurements, and, in cooperation with the National Institute of Standards and Technology (NIST) and the U.S. Department of Agriculture (USDA), operate the Central Calibration and Test Facility for national ultraviolet (UV) monitoring instruments. Other efforts at SRRB include research on the effects of surface UV radiation, improvement of surface radiation instruments and observing techniques, developing and improving calibration and data quality control techniques, running surface radiation networks and conducting basic research. For more research please visit <http://www.srrb.noaa.gov>

CO-2 (Boulder)

Cooperative Institute for Research in Environmental Sciences

The Cooperative Institute for Research in Environmental Sciences (CIRES) is a joint research institute between the University of Colorado and NOAA, established to create synergy between studies of the geosphere, biosphere, atmosphere, hydrosphere, and cryosphere. CIRES consists of some 500 researchers, faculty, students, and staff distributed among nine NOAA laboratories and offices and eight University departments. Interdisciplinary science is promoted through CIRES centers that cross traditional boundaries, including the Center for the Study of Earth from Space, the Colorado Center for Chaos and Complexity, the National Snow and Ice Data Center, the Center for Limnology, and the Climate Diagnostics Center. Much integrated research is being focused upon societal problems such as the potential impacts of climate change, pollutant destruction of Earth's ozone, thinning of polar ice, degradation of air and water quality, and earthquake prediction. For more information please visit <http://cires.colorado.edu>

CO-2 (Boulder) and CO-4 (Ft. Collins)

Cooperative Institute for Research in the Atmosphere

The Cooperative Institute for Research in the Atmosphere (CIRA) in Fort Collins is involved in collaborative research between Colorado State University (CSU) and NOAA. This includes research by CSU faculty and students that applies toward NOAA's Weather and Climate missions. The Institute conducts research activities that include: global and regional climate studies; local and mesoscale area weather forecasting and evaluation; cloud physics; application of satellite observations; air quality and visibility; societal and economic impacts; numerical modeling; and education, training and outreach. CIRA interacts with researchers from several NOAA Laboratories as well as the NOAA National Environmental Satellite and Data and Information Service (NESDIS). The NESDIS Regional and Mesoscale Meteorology Team has co-located programs and personnel with CIRA. One-hundred and fifty-four university researchers, post doc fellows, graduate students, and staff are supported and/or affiliated with CIRA. NOAA funding for CIRA researchers in FY 2001 totaled \$8.3 million. For more information please visit <http://www.cira.colostate.edu>

CO-2 (Boulder)

**Climate and Global Change Program
Paleoclimatology Data Center**

NOAA's Climate and Global Change Program provides support for the NOAA Paleoclimatology Data Center located in Boulder. The Paleoclimatology Data Center coordinates international participation in the compilation of a comprehensive, global, paleoenvironmental database for use by the global change community. Its mission is to provide this community with the paleoclimatology data and information needed to understand and model interannual to centennial-scale environmental variability. For more information please visit <http://www.ngdc.noaa.gov/paleo/>

CO-2 (Boulder)

**Climate and Global Change Program
Western Water Assessment**

NOAA's Climate and Global Change Program provides support for the Western Water Assessment (WWA), an interdisciplinary research project linking climate, water resources, and society. The WWA is being undertaken jointly at the University of Colorado and the NOAA Climate Diagnostics Center. The WWA is charged to conduct integrated interdisciplinary research and to interact with stakeholders in an effort to make the research highly relevant to societal needs. Current research has two overarching goals: 1) to determine the regional sensitivities and responses to climate variations, and 2) to assess and develop hydro-climate products on a regional scale. For more information please visit <http://cires.colorado.edu/wwa/>

CO-2 (Boulder)

**Climate and Global Change Program
University Corporation for Atmospheric Research**

NOAA's Climate and Global Change Program provides support for climate research through the University Corporation for Atmospheric Research. The funding provided support for scientific planning, scientific program management, experimental design studies, post-doctoral fellows, public education, and specialized logistics for climate and global change research projects. For more information please visit <http://www.ucar.edu>

CO-2 (Boulder)

**Aeronomy Laboratory
Health of the Atmosphere Program**

Researchers at the National Center for Atmospheric Research in Boulder are being funded by NOAA to analyze volatile organic carbon data collected as part of the summer-2000 air quality field study in east Texas. The work is being done through NOAA's Health of the Atmosphere Program, which is designed to provide an understanding of the impact of high ozone levels near the Earth's surface. The

mission, based in Houston, was an intensive study of the meteorological and chemical factors that influence air quality in the Houston area. For more information please visit <http://www.utexas.edu/research/ceer/texaqs/>

CO-2 (Table Mountain)

Air Resources Laboratory Surface Radiation Measurement Network

The Surface Radiation Research Branch (SRRB) of the Air Resources Laboratory operates a surface radiation measurement network (SURFRAD) with six stations nationwide, including one at the Table Mountain Test Facility north of Boulder. The station instruments support regional and global weather and climate research with accurate, continuous, long-term measurements of the surface radiation budget over the United States. The measurements provided by this network are essential for validating satellite observations, verifying weather forecasts, and providing important information critical to regional climate variability and changes. Solar radiation is the driving energy for geophysical and biological processes that control weather and affect planetary life; understanding the global surface energy budget is therefore key to understanding climate and the environmental consequences to agriculture and other statewide concerns. For more information, please visit <http://www.srrb.noaa.gov>

CO-2, 3, 4 (Boulder, Grand Junction, Pueblo, Granada, Platteville, Colorado Springs)

Forecast Systems Laboratory GPS Meteorological Observing Systems

NOAA's Forecast Systems Laboratory (FSL) operates a rapidly expanding network of GPS Meteorological (GPS-Met) Observing Systems to monitor the total quantity of precipitable water vapor in the atmosphere. Currently, there are 93 systems over the contiguous 48 states and Alaska, and plans are being made to extend these observations to Hawaii, Puerto Rico, the Caribbean Islands, and Central America. Water vapor is an important but under-observed component of the atmosphere that plays a major role in severe weather events and the global climate system. GPS-Met systems provide accurate water vapor measurements under all weather conditions, including thick cloud cover and precipitation, and do so at very low cost. The major reason why this system is so economical is that the network is being developed by FSL in cooperation with federal, state and local government agencies, universities, and the private sector. The GPS stations provide high-accuracy surveying and navigation services for National defense, automated agriculture, safe land and marine transportation, government infrastructure management, and 911 emergency response services. Fortunately, these systems can also be used for meteorology with the addition of surface weather sensors. GPS-Met systems located in Colorado include sites operated by NOAA near Boulder, Platteville, and Granada. A site near Grand Junction is operated by Mesa County. The U.S. Department of Transportation operates a site near Pueblo, and a site near Colorado Springs is operated by the U.S. Navy. For more information please visit <http://www.gpsmet.noaa.gov/jsp/index.jsp>

CO-3 (Rocky Mountains)

Environmental Technology Laboratory Snowpack Studies

The Environmental Technology Laboratory (ETL) is using its airborne Polarimetric Scanning Radiometer to study snowpack on the Colorado side of the Rocky Mountains as part of the multi-agency Cold Land Processes Experiment (CLPX). The purpose of this experiment is to improve the estimation of snow amount and forecasting of spring flooding due to snowmelt, and to study the role of cold lands within the Earth's climate. ETL's efforts will provide information on how to improve the use of satellite data for monitoring snowpack – an important source of water for irrigation and drinking throughout the western United States. For more information please visit

<http://www.etl.noaa.gov>

CO-4 (Erie)

Environmental Technology Laboratory Boulder Atmospheric Observatory

The Boulder Atmospheric Observatory (BAO) tower is a premier boundary layer observation facility which has been owned and operated by NOAA's Environmental Technology Laboratory (ETL) for more than 25 years. At a height of 300 meters, the BAO is a very unique observational platform situated on the gently rolling plains of eastern Colorado. The BAO was originally constructed to support atmospheric boundary layer probes (e.g., temperature, humidity, wind, and turbulence sensors). Over the years use of the BAO has expanded. NOAA's Climate Monitoring and Diagnostics Laboratory (CMDL) began to make measurements from the top the BAO tower in 1985 in an effort to extend NOAA's radiation observational network and to take advantage of the unique opportunity presented by the tower. The size of the area sampled from the top of the BAO approaches that sampled by satellite or simulated in numerical weather and climate models. The land surface area surrounding the BAO is representative of an area whose complexities make it a challenge to interpret in satellite data or to properly model numerically, but which is similar to a significant portion of the earth's land surface. Additionally the BAO tower site is a participant in the World Climate Research Program's Baseline Surface Radiation Network. For more information please visit <http://www.etl.noaa.gov>

CO-4 (Erie)

Environmental Technology Laboratory Cloud and Precipitation Studies

NOAA's Environmental Technology Laboratory has conducted numerous radar-based cloud and precipitation studies in north-central Colorado in recent years. They were called "SnowRad," a study to investigate new methods for accurately measuring snowfall intensity; "DIPOLE," a study to use new polarization techniques for cloud particle identification (i.e., liquid drops or different types of snow); "WISP," an investigation of new remote-sensing methods to detect icing conditions in clouds that are hazardous to aircraft; and "RainX," an X-band radar field experiment to improve rainfall

estimates over current NEXRAD algorithms. Most of this work is done near Erie, Colorado. For more information please visit <http://www.etl.noaa.gov>

CO-4 (Pawnee Grasslands)

Air Resources Laboratory Atmospheric Integrated Research Monitoring Network

AIRMoN, or Atmospheric Integrated Research Monitoring Network, is an array of sampling stations designed to quantify the extent to which changes in emissions affect air quality and deposition. NOAA's Air Resources Laboratory operates both elements of the network, AIRMoN-Wet and AIRMoN-Dry. The goal of AIRMoN-Dry is to identify and understand the processes that cause the deposition of atmospheric pollutants without the presence of precipitation in order to quantify dry deposition rates at locations where direct measurement is not possible. An AIRMoN-Dry station is located in the Pawnee Grasslands. Prime users of these data include ecologists, agriculturists, foresters, and power companies affected by Clean Air Act legislation. For more information please visit <http://www.arl.noaa.gov>

For further information about these and other NOAA programs, please contact NOAA's Office of Legislative Affairs at (202) 482-4981.

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